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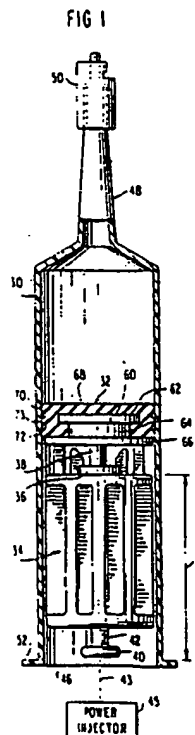
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(94) Volume reducing adapter for power syringe.

(57) An adapter (34; 134) for a syringe for a power injector (45) is provided with engaging and gripping means (90; 136) for being secured to the machine grippable protrusion (36, 38) of a backer plate (88) of the piston (32) of the syringe. The rear end of the adapter (34; 134) has a machine grippable protrusion (40, 42) so that the syringe, having its volume reduced by the length of the adapter (34; 134), can be utilised in a conventional power injection machine (43).



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The present invention relates to syringes for power injection of liquid materials, such as contrast media, into blood vessels to perform uroangiographic procedures.

The prior art, as exemplified in U.S. Patents No. 3,623,474, No. 3,701,345 and No. 4,006,736, contains several power injectors for operating plungers or pistons in syringes to supply liquid contrast media through catheters into blood vessels to enable the producing of X-ray images of organs or blood vessels thereof for medical diagnostic purposes. Generally, the syringes available for a power injector require a relatively large initial volume of contrast media, e.g., 125 or 95 milliliters, to operate properly on the power injector. Often only a portion of contrast media is used, particularly with the newer and more sensitive X-ray and other radiological equipment which is replacing older equipment. Unused contrast media is discarded resulting in unnecessary waste and higher contrast media costs. Existing power injector designs do not allow for their use with partially prefilled syringes.

The present invention seeks to provide a syringe for containing a reduced volume of contrast media and which is suitable for being utilised in existing power injectors.

The invention also seeks to avoid unnecessary costs associated with the manufacture, inventory and supply of different syringe sizes.

The present invention relates to a syringe suitable for a power injector wherein the volume of the syringe may be reduced by including an adapter having means on its forward end for gripping and engaging the backer plate of the conventional syringe piston and having on its rear end a machine grippable protrusion for being gripped and engaged by the plunger of the injector. The adapter has a selected length extending axially in the open end of the barrel of the syringe for advancing the position of the piston to define a predetermined reduced contents volume.

One advantage of the invention is that power injector syringes having different content volumes can be made from syringe barrels of the same size with standard pistons by inserting correspondingly different sizes of adapters which include gripping facilities on the front side for gripping and engaging the backer plate of the piston and which include a machine-grippable protrusion on the rear side thereof for enabling proper operation of the reduced volume syringe by a power injector.

One feature of the invention is that angiography can be performed utilizing a power injector wherein contrast media syringes with smaller volumes of contrast media can be selected, for selected procedures.

Other objects, advantages and features of the invention will be apparent from the following description of the preferred embodiments taken in conjunction with the accompanying drawings, wherein:

Figure 1 is an elevational sectional view of a syringe for use in a power injector in accordance with the invention;

Figure 2 is a top view of an adapter in the syringe of Figure 1;

Figure 3 is an elevation view, taken from the right side of Figure 2, of a broken-away upper portion of the adapter of Figures 1 and 2;

Figure 4 is an elevation view taken from the front of Figure 2, of a broken-away portion including a clip element for securing the adapter to a backer plate;

Figure 5 is a front elevation view of the adapter of Figures 1 and 2;

Figure 6 is a bottom view of the adapter of Figure 5;

Figure 7 is a top view of a modified adapter for use in a syringe in accordance with the invention;

Figure 8 is a front elevation view of the adapter of Figure 7;

Figure 9 is a bottom view of the adapter of Figures 7 and 8; and

Figure 10 is a sectional view of a broken-away portion of a syringe containing the adapter of Figures 7, 8 and 9.

As shown in Figure 1, one embodiment of a syringe for a power injector in accordance with the invention includes a syringe barrel indicated generally at 30, a piston indicated generally at 32 within the barrel 30, and an adapter indicated generally at 34. The piston 32 has a rearward machine-grippable protrusion, such as button 36 on stem 38 which is engaged and gripped by the adapter 34. The adapter 34 has a similar machine-grippable protrusion such as button 40 on stem 42 on its rear end for being gripped by conventional piston engaging and gripping facilities (illustrated by dashed line 43) of a power injection machine 45. The length of the adapter 34, as shown by the arrowed line 44 is selected to advance the piston 32 into the barrel 30 of the syringe to define a predetermined reduced amount of volume in front of the piston in the barrel 30. In the absence of the adapter 34, the machine engaging protrusion 36 of the piston 32 generally must be adjacent to the open end 46 of the barrel in order to be engaged by the power injecting machine 45. However, the adapter 34 with its selected length allows the piston 32 to be displaced toward the nozzle end of the syringe by the distance 44 without disrupting the operation of the piston engaging and gripping facilities 43 of the power injector 45.

The syringe barrel 30 is a conventional syringe barrel made of polypropylene or a co-polymer of polypropylene and polyethylene or other suitable material and preferably clear or translucent so that the presence of contents therein can be observed. Additionally, the barrel 30 may have conventional markings (not shown) on the exterior thereof indicating the quantity of liquid within the barrel. The upper end of the barrel 30 has a nozzle 48 with a conventional nut 50 threadably mounted thereon for securing a luer of a catheter (not shown) to the syringe in a conventional manner. While Figure 1 illustrates the nut 50 mounted on the nozzle 48, the nut 50 can, if desired, be provided as a separately packaged sterilized item. A flange 52 is provided on the open end 46 of the barrel for securing the syringe to the power injector machine 45 in a conventional manner.

The piston 32 includes a backer plate 60 formed of molded rigid plastics with a rear disc-like portion 66, on which the stem 38 and button 36 are centrally mounted, a cylindrical center portion 64 and an expanded forward portion 62. An elastomeric or rubber closure 68 is fitted over the forward portion 62, engaging in the cylindrical center portion 64. The outer edges of the cap 68 have three ringed portions 70, 72 and 73 which form a double seal with the barrel 30.

The adapter 34, as shown in Figures 2, 5 and 6, is formed from a molded plastics material, such as polypropylene or other polymer, which is preferably injection molded to the desired shape. The adapter 34 has a body portion 80 which is conveniently formed by a series of ribs 82 and a back plane 84 extending between a front disc 86 and a rear disc 88. The stem 42 and button 40 are formed centrally on the rear disc 88. The gripping facilities for engaging and gripping the backer plate 60 of the piston 32 include a pair of clips 90 and a pair of abutment members 92 extending forward from the front disc 86. The clips 90, as shown in Figure 4, have a neck portion 94 which defines a recess 96 for receiving the edge of the button 36 and an enlarged upper or head portion 98 which defines an edge 100 for engaging the forward or top surface of the button 36, as shown in Figure 1. Preferably, the surface 100 is undercut so as to form an angle 101 inclined downward, for example, 5°, so as to ensure that loss of resilience or engagement with the button 36 does not result in an upward sloped surface which can readily release the button 40 upon withdrawal of the adapter. Camming surfaces 102 are formed on the upper inner edges of the clips 90 for engaging the edges of the button 36 as the adapter 34 is moved forward against the piston 32 so that the clips 90 are readily flexed apart to permit button 36 to slip past the enlarged head portion 98 and to snap into

position within the recess 96 to be held there by the edge 100. As shown in Figure 3, the abutments 92 have a trapezoidal configuration with a height selected to engage the surfaces of the rear portion 66 of the backer plate concurrently with the engagement of the button 36 by the clips 90. The abutment members 92 are located on opposite sides of the clip members 90 for providing a stable base for power advancement of the piston 32.

A modified adapter 134 illustrated in Figures 7, 8, 9 and 10 has portions, identified by the same numerals as the embodiment of Figures 1-6, indicating similar structure and function. The adapter 134 contains modified clips 136 for engaging the button 36 of the plunger 32 and has modified abutments 138 mounted on the upper disc 86. The abutments 138 are small rectangular abutments, while the clips 136 are extended longitudinally from the rear to the back so as to accommodate an extended base 140 of the backer plate 60. The extended base 140 of the backer plate 60 is tapered so that the circular surface 142 which engages the modified adaptor 134 has a diameter which is smaller than the barrel diameter. The height of the clips 136 is made equal to the height of the abutments 138 so that the clips 136 can share in the applying and engaging force to the modified backer plate with the tapered extension 140. It is seen that the clips 136 and abutments 138 occupy a smaller circular area of the disc 86 corresponding to the smaller circular surface 142 on the tapered portion 140 of the backer plate.

The present invention provides substantial economic improvements in syringes for power injectors by including an adapter of a selected length to enable the economical production of reduced volume syringes, thus avoiding the cost and waste of unused contrast media that would normally not be used. The employment of the relatively low cost adapters avoids the expense of manufacture and inventory of various sizes of syringe barrels in order to supply power syringes with varying reduced quantities of injection fluid.

Since many modifications, variations and changes in detail can be made to the above described embodiments without departing from the scope and spirit of the invention, it is intended that all matter shown in the foregoing description and shown in the accompanying drawings be interpreted as only illustrating one or more embodiments of many possible embodiments of the invention and as not limiting the scope and spirit of the invention as defined in the following claims.

Claims

1. An adapter (34; 134) for adjusting the internal volume of a syringe of a type known per se containing a liquid contrast medium for use in uroangiographic procedures, said syringe being for use with a power injector of a type known per se and including a piston (32) which slides within a cylindrical barrel (30) of said syringe and has a backer plate (60) with a machine grippable protrusion (36, 38) thereon, and said power injector (45) having piston engaging and gripping means (43) for gripping and engaging the grippable protrusion (36, 38) on said piston (32), said adapter comprising a generally elongate body configured for insertion into said barrel (30) and comprising:
 - (a) a front disc (86) having centrally disposed on one side thereof, and extending outwardly from the adapter body, gripping means capable of engaging the grippable protrusion (36, 38) on the piston (32) to maintain the adapter (34; 134) and the piston (32) in an abutting relationship, said gripping means comprising a pair of resilient clips (90; 136) for engaging and holding the machine grippable protrusion (36, 38) on the piston (32) and a pair of abutment members (92; 138) located on opposite sides of the resilient clips (90; 136) and extending forward from the front disc (86);
 - (b) a rear disc (88) which is disposed coaxially with the front disc (86), said rear disc (88) having centrally disposed on one side thereof and extending outwardly from the adapter body a machine grippable protrusion (40, 42) for engagement by the piston engaging and gripping means (43) of the power injector (45); and
 - (c) a central body portion (80) connecting said front disc (86) and said rear disc (88).
2. An adapter according to claim 1, wherein each of the clips (90; 136) comprises a neck portion (94) defining a recess (96) for receiving the edge of a button (36) on the grippable protrusion of a piston and head portion (98) defining a ledge (100) for engaging a forward surface of said button (36).
3. An adapter according to claim 1 or claim 2, wherein the head portion (98) of each clip (90; 136) has an inwardly facing camming surface (102) disposed to bear on the edge of the button (36) of a machine grippable protrusion (36, 38) to force the clips (90; 136) apart as the adapter (34; 134) is brought into abutting contact with the piston (32).
4. An adapter according to any one of claims 1 to 3, wherein the machine grippable protrusion (42) extending outwardly from the rear disc (88) comprises a stem (42) having a button (40) affixed to the end thereof.
5. An adapter according to any one of claims 1 to 4, wherein the central body portion (80) comprises a back plane (84) and a plurality of ribs (82) extending between the front disc (86) and rear disc (88), said ribs (82) intersecting the back plane (84) at right angles.
6. A method of reducing the volume of a syringe of a type known per se containing a liquid contrast medium for use in uroangiographic procedures with a power injector (45) of a type known per se, said syringe including a piston (32) which slides within a cylindrical barrel (30) of said syringe and has a backer plate (60) with a machine grippable protrusion (36, 38) thereon, and said power injector (45) having piston engaging and gripping means (43) for gripping and engaging the grippable protrusion (36, 38) on said piston (32), which method comprises interposing between said piston (32) and said piston engaging and gripping means (43) an adapter (34; 134) comprising a generally elongate body configured for insertion into said barrel (30) and comprising:
 - (a) a front disc (86) having centrally disposed on one side thereof, and extending outwardly from the adapter body, gripping means capable of engaging the grippable protrusion (36, 38) on the piston (32) to maintain the adapter (34; 134) and the piston (32) in an abutting relationship, said gripping means comprising a pair of resilient clips (90; 136) for engaging and holding the machine grippable protrusion (36, 38) on the piston (32) and a pair of abutment members (92; 138) located on opposite sides of the clips (90; 136) and extending forward from the front disc (86);
 - (b) a rear disc (88) which is disposed coaxially with the front disc (86), said rear disc (88) having centrally disposed on one side thereof and extending outwardly from the adapter body a machine grippable protrusion (40, 42) for engagement by the piston engaging and gripping means (43) of the power injector; and
 - (c) a central body portion (80) connecting said front disc (86) and said rear disc (88);
 wherein said machine grippable protrusion (40, 42) on said rear disc (88) is engaged and gripped by said piston engaging and gripping means (43) of said power injector (45), said

grippable protrusion (36, 38) on said piston (32) is gripped by said pair of resilient clips (90; 136), and said backer plate (60) is engaged by said abutments (92).

- 5
7. A method according to claim 6, wherein each of the clips (90; 136) comprises a neck portion (94) defining a recess (96) for receiving the edge of a button (36) on the grippable protrusion of a piston and a head portion (98) defining a ledge (100) for engaging a forward surface of said button (36). 10
8. A method according to claim 6 or claim 7, wherein the head portion (98) of each clip (90; 136) has an inwardly facing camming surface (102) disposed to bear on the edge of the button (36) of a machine grippable protrusion (36, 38) and forces the clips (90; 136) apart as the adapter (34; 134) is brought into abutting contact with the piston (32). 15 20
9. A method according to any one of claims 6 to 8, wherein the machine grippable protrusion (42) extending outwardly from the rear disc (88) comprises a stem (42) having a button (40) affixed to the end thereof. 25
10. A method according to any one of claims 6 to 9, wherein the central body portion (80) comprises a back plane (84) and a plurality of ribs (82) extending between the front disc (86) and rear disc (88), said ribs (82) intersecting the back plane (84) at right angles. 30 35 40 45 50 55

FIG. 1

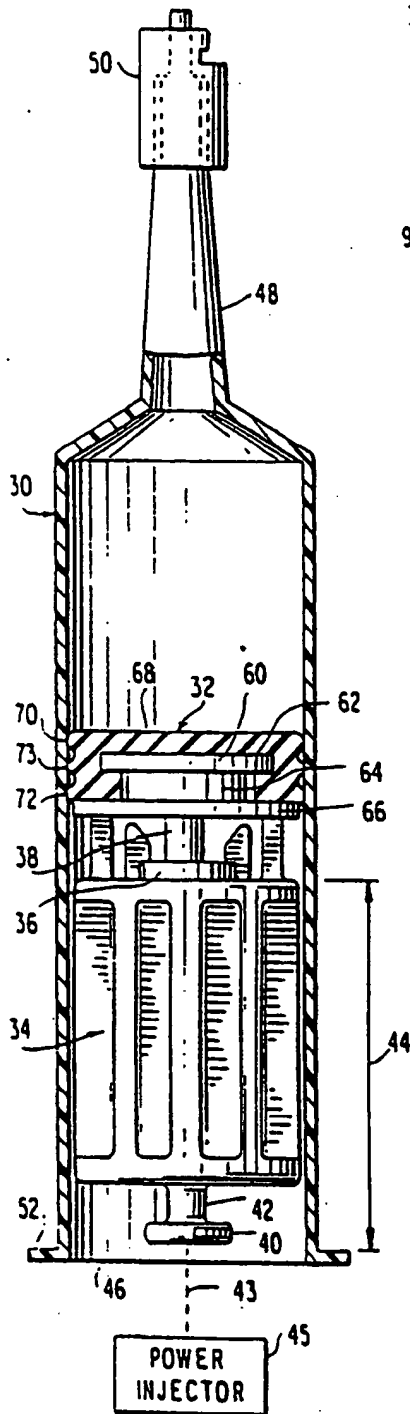


FIG. 2

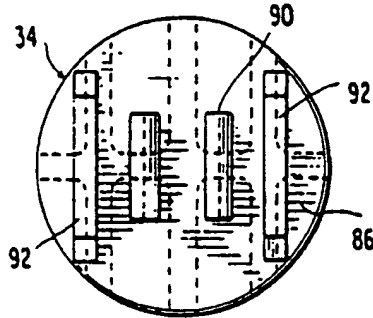


FIG. 3

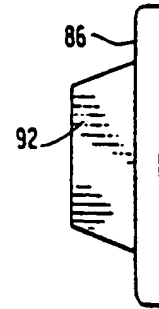


FIG. 4

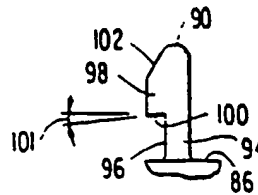


FIG. 5

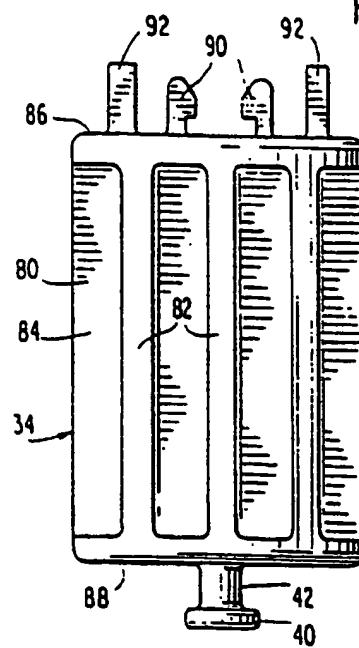


FIG. 6

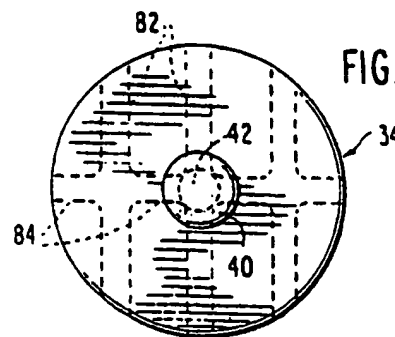


FIG. 7

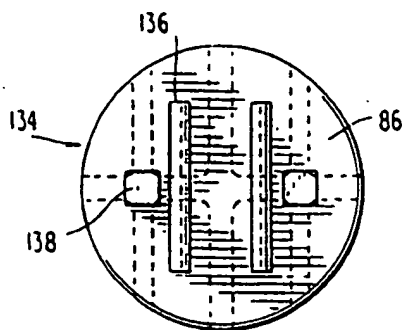


FIG. 8

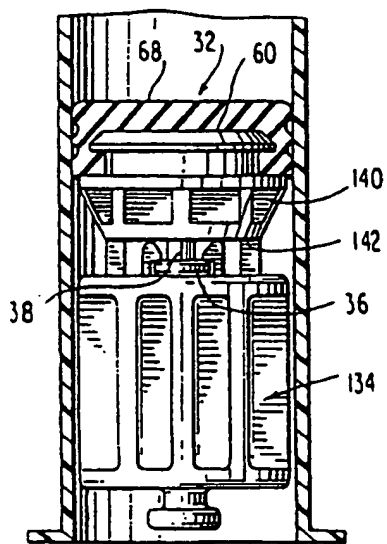
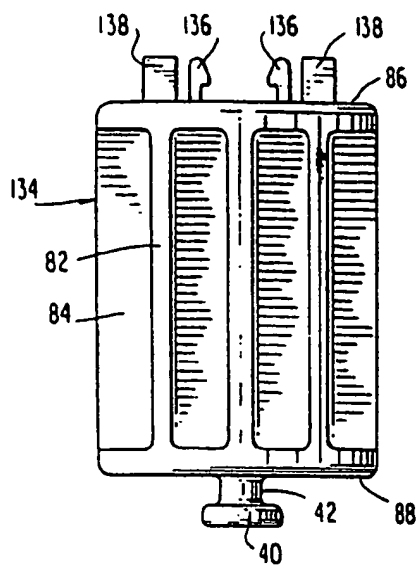


FIG. 10

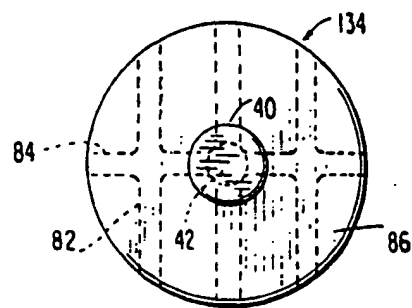


FIG. 9



European
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EUROPEAN SEARCH REPORT

Application Number

EP 91 12 1913

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-2 381 527 (JAPAN MEDICAL SUPPLY CO., LTD.) " figures 1-9 "	1	A 61 M 5/315 A 61 M 5/145
A,D	US-A-4 006 736 (KRANYS ET AL.) " figure 22 "	1	
A	DE-A-2 733 526 (CONTRAVES AG) " figures 1,2 "	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 61 M A 61 B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 24 February 92	Examiner SEDY, R.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document			